Laminate with fill layer

The invention relates to a laminate of alternating metal layers and at least one plastic bonding layer, which metal layers each comprise two metal layer sections that have mutually overlapping edges bonded to one another.

Such laminates are known. The laminate concerned can be a laminate where the metal layers are bonded to one another by an adhesive layer, or a laminate where there are one or more fibre layers impregnated with an adhesive between the metal layers. As a consequence of the overlap of the metal layer sections, the laminate has an unevenness that in some cases can give rise to disadvantages. If the laminate is fixed to a structural component such as a frame, one of the metal layer sections must be joggled to ensure that both metal layer sections can be in direct contact with the frame. In the case of an aircraft's skin this means that the outside thereof also has a joggle, which can be undesirable for aerodynamic reasons.

The aim of the invention is, therefore, to provide a laminate of the type described above that does not have these disadvantages. Said aim is achieved in that a fill is provided which has a thickness at least such that at the location of the fill the laminate has a thickness equal to the thickness at the location of the overlapping edges.

In the case of the laminate according to the invention there is no joggle on either side, such that for assembly on, for example, a frame, the side facing away from the latter can remain completely flat. Preferably, the fill layer is directly alongside two mutually overlapping edges, such that both sides of the laminate have as uniform as possible a shape. In this context there can be a fill on either side of two mutually overlapping edges.

The edge of one of the mutually overlapping metal layer sections can be joggled such that the metal layer sections of a metal layer are essentially in the extension of one another. In this case the fills can also be in the extension of one another.

As already mentioned above, the laminate can advantageously be joined to a frame. In this case it is not necessary to provide the complete laminate with fills. Consequently, the laminate can comprise a part in which there is at least one fill as well as a part without fill.

The fill can be implemented in various ways. For instance, the fill can comprise at least one plastic bonding layer. Several metal layers and several plastic bonding layers can also be concerned here. The fill can also comprise a metal layer with a thickness greater

than that of the other metal layers. However, the plastic bonding layer must then be correspondingly thinner. The plastic bonding layers can consist simply of an adhesive layer, or of fibre layers impregnated with adhesive.

The invention will be explained in more detail below with reference to an illustrative embodiment shown in the figures.

Figure 1 shows a plan view of a laminate according to the invention.

Figure 2 shows the section according to II-II in Figure 1.

The laminate shown in Figure 1 comprises three laminate parts 1, 2, 3 that are fixed to one another by means of joins 4 and 5. Furthermore, it is possible to differentiate two regions in the laminate, i.e. a region 6 where there is a fill indicated in its entirety by 8 between the layers of the laminate and a region without fill, or to put it another way, the standard laminate 7. At the location of the region 6 the laminate can be fixed to another laminate by means of strip 9.

It is known that at the location of the joins 4, 5 the standard laminate has a somewhat greater thickness because the edges of the laminate overlap one another there. This means that at least one side of the laminate is not flat but is stepped to some extent. This is not desirable in some applications. In the case of an aircraft skin, for example, it is better if both sides of the laminate are completely flat. The frames 9 can then be attached to one side, the inside, while the other side nevertheless has aerodynamic properties because of the completely flat form thereof. Flatness of the surface of the laminate can also be desirable for other reasons. The fitting of underlying structural elements such as stiffeners, edge reinforcements for hatches or covers, corners of door openings and the like are mentioned as further examples.

According to the invention, the fill indicated in its entirety by 8 is therefore arranged in the region 6 at the location of the join to the frame 9. Said fill is not needed outside said region 6, that is to say in the region 7. The outside of the laminate is completely flat in that region, but it is not a problem if the inside of the laminate is stepped in this location. After all, a frame does not have to be attached to the laminate at that location.

As shown in Figure 2, the joins 4, 5 are implemented in a known manner with overlapping edges of the metal layers 10, 11, 12 and 13. These metal layers are bonded to one another by means of fibre-reinforced bonding layers 14, 15, 16 and 17. However, the metal layers can also be bonded directly to one another by means of an adhesive, without fibre layers between them.

At the location of the joins 4, 5, each metal layer 10 - 13 forms two metal layer sections 18, 19, with respective overlapping edges 20 and 21, respectively. These overlapping edges are fixed to one another by means of an adhesive 22 for transferring stresses in the laminate by means of shear forces.

According to the invention, fills 8 in the form of metal layers 25, 24 in combination with plastic bonding layers 28, 29 are arranged on either side of the overlapping edges 20, 21 of the metal layer 10. As shown in Figure 1, there are several fills, depending on the number of joins 4, 5. The fills have a thickness that is equal to the sum of the thickness of one of the metal layers 10 - 13 plus the thickness of one of the plastic bonding layers 14 - 17, such that on either side of the joins 4, 5 the thickness of the laminate is the same as that of the laminate at the location of the joins 4, 5. Both sides 26, 27 of the laminate are completely flat as a result.